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**SECRET**  
**SECURITY INFORMATION**

Report No. L2810-11

**ENGINEERING CORPORATION**

AZUSA, CALIFORNIA

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**N F O R M A L   R E P O R T   O F   P R O G R E S S**

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No.

15 May 1953

TO: Head, Armament Branch  
Naval Sciences Division  
Office of Naval Research  
Washington 25, D. C.

VIA: Bureau of Aeronautics Representative  
Aerojet-General Corporation  
6352 N. Irwindale  
Azusa, California

SUBJECT: Development of a Device for Mine-Sweeping

CONTRACT: Nonr-686(00)

PERIOD  
COVERED: 1 April through 30 April 1953

This is the eleventh in a series of  
informal reports submitted in partial  
fulfillment of the contract.

AEROJET-GENERAL CORPORATION

*C. A. Gongwer*  
C. A. Gongwer  
Manager  
Underwater Engine Division

NOTE: The information contained herein is regarded as preliminary  
and subject to further checking, verification, and analysis.

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Report No. L2810-11

## I. OBJECTIVE

In accordance with Contract Nonr-686(00), as amended by Amendment No. 1, 1 December 1952, the following work is to be performed:

The Contractor shall (1) conduct research on pulsed-pressure signals; (2) design and construct an experimental vortex-ring generator of approximately prototype size for sea tests and development work; and (3) concurrently with the work required under (1) and (2), investigate the practical problems attending the use of such a device as a mine countermeasure and attempt to provide solutions to these problems, in order that the device may be readily applied to naval uses. This work shall include, but not necessarily be limited to, the following:

- A. Completion of the prototype design
- B. Construction of the prototype
- C. Mounting and testing of the prototype on a Navy-furnished vessel

D. Concurrently with prototype development, the investigation of effects caused by non-vertical projection of the vortex, by motion of the generator during projection of the vortex, by the nature of the bottom, etc., upon the efficacy of the ring vortex in mine sweeping.

## II. DESCRIPTION OF WORK

A. Tests were conducted on the barge-mounted, 1/8-scale vortex generator to prove the feasibility of injecting heated gasoline into the chamber under pressure. In tests made to date, gasoline at 200°F has been injected under a pressure of 35 to 125 psig. In each instance, firing has taken place. Some additional work on control of the quantity of fuel injected is needed to make all gasoline-air explosions of the same general intensity. However, the forced injection of heated fuel seems far superior to the previous system, that of dropping the fuel onto a heated surface, at least as far as reliability of burning is concerned.

B. Tests on the same installation were conducted to determine the barge oscillation frequency under recoil conditions. Essentially, this is a problem in simple harmonic motion, but the damping and additional mass involved in accelerating and decelerating the surrounding waters make the problem somewhat indeterminate without empirical data for verification. Using the

formula  $t = 2\pi\sqrt{\frac{M}{K}}$ , where  $M$  is the mass of the moving body and  $K$  is the restoring force per unit displacement, the period of oscillation of the 1/8-scale barge was computed to be 1.585 sec. Tests, however, show a period of 2.0 sec. This corresponds to a mass of 1.6 times the actual mass of the barge, indicating that considerable amounts of water are accelerated.

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C. Fabrication of the prototype ring-vortex generator is in progress. Piping and wiring diagrams, as well as exact weight and space requirements of auxiliary equipment, are in preparation. These diagrams are being prepared on the premise that installation will be made on a YC-type barge.

D. Direct liaison has been initiated between Aerojet-General and the U. S. Navy Mine Countermeasures Station, Panama City, Florida. At a recent meeting of representatives of Aerojet-General, NMCS, ONR, and BuShips, plans were made for the use of a YC-type barge, and instrumentation and electrical power supply were discussed. At present the acquisition of the barge and electrical power supply is awaiting CNO's approval. It is currently planned to use inert-loaded mines, with firing mechanisms installed, for bottom instrumentation. NMCS, Panama City, will investigate the problem of installing a recording system into the firing mechanisms so that indications of pressure-switch action can be obtained, as well as indications of the action of the magnetic switching arrangement. Only by using actual mine mechanisms can it be definitely determined whether or not all the actuating switches will be tripped by the action of the expanding vortex. Any other method of recording conditions on the ocean floor, it is believed, would require subsequent analysis and the use of a simulator for mine detonation studies.

### III. WORK PLANNED FOR THE NEXT REPORT PERIOD

A. Fabrication of the prototype generator will be continued.

B. Testing of the 1/8-scale, barge-mounted, model vortex generator will be continued along two basic lines: (1) Improvement of the ignition and fuel-injection methods, and (2) simplification of the system of projecting ring vortices in a non-vertical direction by the use of curved-barrel generators, and by the installation of non-horizontal exit sections on a vertical generator barrel. Non-vertical vortex projection with a vertical mount would greatly simplify the installation problem. The investigation of a simplified method of non-vertical projection will be intensified.

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